

Research Note

Some Trematode, Nematode, and Acanthocephalan Parasites of Rainbow Trout, *Oncorhynchus mykiss*, Introduced into Chile

PATRICIO TORRES

Instituto de Parasitología, Universidad Austral de Chile, Valdivia, Chile

ABSTRACT: The gastrointestinal tracts of 211 adult *Oncorhynchus mykiss* (Walbaum, 1792) were examined for trematode, nematode, and acanthocephalan parasites from 8 lakes in southern Chile (between 41°05' and 39°03' south latitude). The parasites *Derogenes patagonicus*, *Acanthostomoides apophalliformis*, *Camallanus corderoi*, *Hysterothylacium* sp., *Acanthocephalus tumescens*, and *Acanthocephalus* sp. were present. *Camallanus corderoi* and *D. patagonicus* were present in 8 and 6 lakes, respectively. In 6 lakes, the prevalence was higher for *C. corderoi* compared to 2 other lakes. In 3 different lakes, the mean intensities were higher for *D. patagonicus* (Lakes Rupanco, Puyehue, and Maihue) and *C. corderoi* (Lakes Ranco, Colico, and Caburga) with respect to other species. Acanthocephalans were infrequent in rainbow trout, except for *A. tumescens* in Lake Villarrica.

KEY WORDS: Trematoda, *Derogenes patagonicus*, *Acanthostomoides apophalliformis*, Nematoda, *Camallanus corderoi*, *Hysterothylacium* sp., Acanthocephala, *Acanthocephalus tumescens*, *Acanthocephalus* sp., Salmonidae, *Oncorhynchus mykiss*, prevalence, intensity.

The successful introduction of salmonids into Chile was carried out from Hamburg in 1905 (Golusda, 1927), and their production in fish hatcheries has undergone an important development since 1981 (Alvarado et al., 1990). Research on the parasitic helminths of wild salmonids is important because of zoonotic implications, damage to fish tissues, potential risk of transmission to fish hatcheries, and impact on the tourist activity in the lake region of southern Chile (Wetzlar, 1979; Torres et al., 1989). This note presents information on the prevalence and mean intensity of 6 helminth species in the gastrointestinal tract of rainbow trout, from 8 lakes in southern Chile, where no previous records have been made of these parasite groups.

Between 1989 and 1990, 211 adult rainbow trout (Salmonidae), were examined. They were caught with 5-, 10-, and 20-mm mesh gill nets in the following lakes (geographic locality/number of fish/standard length in centimeters [$\bar{x} \pm \text{SD}$]): Todos los Santos (41°05'S, 72°15'W/14/30 \pm 6.2), Rupanco (40°46'S, 72°30'W/27/32.3 \pm 7.3), Puyehue (40°36'S, 72°26'W/30/29.2 \pm 6.5),

Maihue (40°15'S, 72°02'W/33/28.1 \pm 7.4), Ranco (40°11'S, 72°22'W/30/27.2 \pm 7.4), Villarrica (39°13'S, 72°06'W/29/29.4 \pm 5.2), Caburga (39°06'S, 71°45'W/27/33.8 \pm 4.7), and Colico (39°03'S, 71°59'W/21/29.4 \pm 7.6). Dead fish were kept at 4°C and examined within 72 hr of collection. Procedures of host necropsy, fixation, staining, and/or clearing of parasites followed those of Torres et al. (1990a, 1992). The definitions of prevalence, mean intensity, and locality adhere to Margolis et al. (1982). Representative helminths were deposited in the Collection of the Institute of Parasitology, Universidad Austral de Chile: *Derogenes patagonicus* (IPUAT 233–236), *Camallanus corderoi* (IPUAT 237–241), *Acanthocephalus tumescens* (IPUAT 242–243), *Acanthocephalus* sp. (IPUAT 244), *Hysterothylacium* sp. (IPUAT 245), and *Acanthostomoides apophalliformis* (IPUAT 246).

The prevalence and mean intensity of the 6 helminth species in rainbow trout from 8 lakes are given Table 1. The taxa consisted of 2 trematode species, *Derogenes patagonicus* (Szidat, 1956) and *Acanthostomoides apophalliformis* Szidat, 1956; 2 nematode species, *Camallanus corderoi* Torres, Teuber, and Miranda, 1990, and *Hysterothylacium* sp.; and 2 acanthocephalan species, *Acanthocephalus tumescens* (Linstow, 1896) and *Acanthocephalus* sp. *Derogenes patagonicus* was found in the stomach, whereas the other species occurred in the intestine. All helminth species are first records for rainbow trout in the lakes studied.

The specimens of *D. patagonicus*, *Acanthocephalus* sp., and *A. tumescens* were represented by adults, sometimes gravid worms, and juveniles. The specimens of *C. corderoi* were adults and fourth-stage larvae (L4s). The only specimens of *A. apophalliformis* and *Hysterothylacium* sp. were a gravid adult and a male, respectively.

Three helminth taxa of various assemblages were present in rainbow trout from 6 of the 8 lakes, with the exception of Lakes Caburga and

Puyehue, where 1 and 2 species, respectively, were recorded. *Camallanus corderoi* was the only parasite infecting rainbow trout from all 8 lakes, whereas *D. patagonicus* was found in 6 lakes.

In the majority of lakes, the prevalence was higher for *C. corderoi* compared to Lakes Rupanco and Todos los Santos. The mean intensities were higher for *D. patagonicus* in Lakes Rupanco, Puyehue, and Maihue compared to 5 other lakes and *C. corderoi* in Lakes Ranco, Caburga, and Colico. The mean intensity of *A. tumescens* was highest in Lake Villarrica.

Camallanus corderoi was described in perch trout, *Percichthys trucha*, in the Valdivia River basin, Chile (Torres et al., 1990b). Later, it was recorded in wild-introduced salmonids, *O. mykiss*, and brown trout, *Salmo trutta*, in the same basin (Torres et al., 1991a) and in rainbow trout cultured in Lake Puyehue (Torres et al., 1993). Analysis of the diet of wild salmonids suggests that the transmission of *C. corderoi* is augmented by the frequent consumption of other autochthonous plankton-eating fishes (especially *Galaxias* spp.), which harbor L4s and immature adults (Torres et al., 1991a). *Derogenes patagonicus* was described by Szidat (1956) in *P. trucha* in the Argentinian Patagonia. In Chile, *D. patagonicus* has been recorded in *O. mykiss* and *S. trutta* in Lakes Yelcho (43°16'S, 72°15'W) and Tagua Tagua (41°39'S, 72°09'W) (Torres et al., 1992).

Acanthocephalus tumescens was described by Linstow (1896) from the Patagonian pejerrey, *Atherinichthys microlepidotus*, from Argentina. Simultaneous infections by *A. tumescens* and *Acanthocephalus* sp. were not observed in rainbow trout. *Acanthocephalus tumescens* occurred only in rainbow trout from Lakes Maihue, Ranco, and Villarrica. The mean intensity of *Acanthocephalus* spp., in general, was low, except in Lake Villarrica, where *A. tumescens* had a mean intensity of 22.2.

Acanthocephalus tumescens and *Acanthocephalus* sp. have been recorded in rainbow trout, brown trout, puye, and southern smelt, *Aplochiton taeniatus*, in Lake Yelcho (Torres et al., 1992). *Acanthocephalus* sp. has also been recorded in *P. trucha* from Lake Tagua Tagua (Torres et al., 1992).

The presence of *A. apophalliformis* and *Hysterothylacium* sp. in rainbow trout from Lakes Rupanco and Ranco, respectively, seems to be "accidental" by low prevalence. *Hysterothylacium* sp. is recorded for the first time in rainbow

Table 1. Prevalence and mean intensity of helminth parasites from *Oncorhynchus mykiss* in 8 lakes from southern Chile.

Lake Helminth taxon	No. infected fishes (% prevalence)	Mean intensity (maximum)
Caburga (27)*		
<i>Camallanus corderoi</i>	2 (7)	10.5 (17)
Colico (21)		
<i>Derogenes patagonicus</i>	2 (10)	2.5 (3)
<i>Camallanus corderoi</i>	6 (29)	8.3 (27)
<i>Acanthocephalus</i> sp.	3 (14)	2.3 (5)
Maihue (33)		
<i>Derogenes patagonicus</i>	5 (15)	15.4 (58)
<i>Camallanus corderoi</i>	9 (27)	5.9 (25)
<i>Acanthocephalus tumescens</i>	5 (15)	1.8 (3)
Puyehue (30)		
<i>Derogenes patagonicus</i>	10 (33)	82.8 (280)
<i>Camallanus corderoi</i>	14 (47)	23.6 (101)
Ranco (30)		
<i>Camallanus corderoi</i>	6 (20)	9.8 (31)
<i>Acanthocephalus tumescens</i>	4 (13)	5.8 (10)
<i>Hysterothylacium</i> sp.	1 (3)	1.0
Rupanco (27)		
<i>Derogenes patagonicus</i>	13 (48)	24.7 (85)
<i>Acanthostomoides apophalliformis</i>	1 (4)	1.0
<i>Camallanus corderoi</i>	12 (44)	12.3 (89)
Todos los Santos (14)		
<i>Derogenes patagonicus</i>	1 (7)	1.0
<i>Camallanus corderoi</i>	1 (7)	1.0
<i>Acanthocephalus</i> sp.	4 (29)	1.5 (2)
Villarrica (29)		
<i>Derogenes patagonicus</i>	1 (3)	2.0
<i>Camallanus corderoi</i>	16 (55)	10.9 (49)
<i>Acanthocephalus tumescens</i>	6 (21)	22.2 (120)

* Number of fishes examined.

trout from Chile. Torres et al. (1992) reported that this species had a low intensity (1–3) in brown trout and perch trout in Lakes Yelcho and Tagua Tagua, respectively.

Acanthostomoides apophalliformis was described by Szidat (1956) in perch trout in Lake Pellegrini, located in the Argentinian Patagonia. In Chile, it was recorded in perch trout from Lake Tagua Tagua with a prevalence of 45% and a mean intensity of 38. Their metacercariae have been observed in the liver of puye and juvenile southern smelt in Lakes Yelcho and Tagua Tagua (Torres et al., 1992).

The 6 helminth species infecting rainbow trout in the present study have been found previously

in autochthonous Chilean fishes (Torres et al., 1990a, b, 1992). These fishes act as reservoirs from which infections have apparently developed in introduced salmonids. In regard to salmonid breeding in the lakes of southern Chile, the presence of parasites in introduced and autochthonous fishes should be considered. This parasitological knowledge should precede initiation of intensive salmon breeding activities in limnetic ecosystems in order to assess potential risk factors to fish populations.

Prevalence, mean intensity, and pathology by *Diphyllbothrium latum* and *Diphyllbothrium dendriticum* have been reported in rainbow and brown trouts in lakes from southern Chile (Torres et al., 1991b). Infection by *D. latum* has been reported in humans associated with consuming raw and smoked salmonids in Chile (Torres et al., 1989).

Acknowledgments

Funding for this study was provided by grants 69/89 (FONDECYT) and S-92-01 (Dirección de Investigación, Universidad Austral de Chile).

Literature Cited

- Alvarado, V., J. W. Schafer, R. Enriquez, and M. Monrás. 1990. Salmonicultura en Chile, estado actual, proyecciones y estado sanitario. Medio Ambiente 11:9-14.
- Golusda, P. 1927. Aclimatación y cultivo de especies salmonídeas en Chile. Boletín de la Sociedad de Biología de Concepción 1:80-100.
- Linstow, O. von. 1896. Nematelminthen. Ergebnisse der Hamburger Magalhaensischen Sammelreise 1892-1893. Heftausgegeben von Naturhistorischen Museum zu Hamburg. III BAND. Briozoen und Würmer. Friederichsen und Co., Hamburg. 22 pp.
- Margolis, L., G. W. Esch, J. C. Holmes, A. M. Kuris, and G. A. Schad. 1982. The use of ecological terms in parasitology (report of an ad hoc committee of The American Society of Parasitologists). Journal of Parasitology 68:131-133.
- Szidat, L. 1956. Über die Parasitenfauna von *Percichthys trucha* (Cuv. and Val.) Girard der patagonischen Gewässer und die Beziehungen des Wirtsfisches und seiner Parasiten zur paläarktischen Region. Archiv für Hydrobiologie 51:542-577.
- Torres, P., X. Cabezas, J. Arenas, J. C. Miranda, C. Jara, and C. Gallardo. 1991a. Ecological aspects of nematode parasites of introduced salmonids from Valdivia River basin, Chile. Memorias do Instituto Oswaldo Cruz, Rio de Janeiro 86:115-122.
- , A. Contreras, V. Cubillos, W. Gesche, A. Montefusco, C. Rebolledo, A. Mira, J. Arenas, J. C. Miranda, S. Asenjo, and R. Schlatter. 1992. Parasitismo en peces, aves piscívoras y comunidades humanas ribereñas en los lagos Yelcho y Tagua-Tagua, X Región de Chile. Archivos de Medicina Veterinaria 24:77-92.
- , V. Cubillos, W. Gesche, C. Rebolledo, A. Montefusco, C. Miranda, J. Arenas, A. Mira, M. Nilo, and C. Abello. 1991b. Difilobotriasis en salmonídeos introducidos en lagos del sur de Chile: Aspectos patológicos, relación con infección humana, animales domésticos y aves piscívoras. Archivos de Medicina Veterinaria 23:165-183.
- , R. Franjola, J. Perez, S. Auad, F. Uherek, J. C. Miranda, L. Flores, J. Riquelme, S. Salazar, C. Hermosilla, and R. Rojo. 1989. Epidemiología de la difilobotriasis en la cuenca del río Valdivia, Chile. Revista de Saúde Pública 23:45-57.
- , W. Gesche, and O. Garrido. 1993. Primer registro de *Camallanus corderoi* Torres, Teuber y Miranda, 1990 (Nematoda: Camallanidae) en salmonídeos cultivados en el lago Puyehue, Chile. Boletín Chileno de Parasitología 48:51-54.
- , E. Ruiz, C. Rebolledo, A. Mira, V. Cubillos, N. Navarrete, W. Gesche, A. Montefusco, L. Valdés, and A. Alberdi. 1990a. Parasitismo en peces y comunidades humanas ribereñas de los lagos Huillínco y Natri (Isla Grande de Chiloé), Chile. Boletín Chileno de Parasitología 45:47-55.
- , S. Teuber, and J. C. Miranda. 1990b. Parasitismo en ecosistemas de agua dulce de Chile. 2. Nematodos parásitos de *Percichthys trucha* (Pisces: Serranidae) con la descripción de una nueva especie de *Camallanus* (Nematoda: Spiruroidea). Studies on Neotropical Fauna and Environment 25:111-119.
- Wetzlar, H. 1979. Beiträge zur Biologie und Bewirtschaftung von Forellen (*Salmo gairdnerii* und *S. trutta*) in Chile. Dissertation zur Erlangung des Doktorgrades vorgelegt der Fakultät für Biologie der Albert-Ludwigs-Universität in Freiburg, Deutschland. 264 pp.